stripped of its bark, to thus survive for three seasons? JAS. LEWIS HOWE.

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SPECIAL ARTICLES.

PHYSICAL CHARACTERS AND HISTORY OF SOME NEW YORK FORMATIONS.[1]

WE are accustomed to define historical geology as the history of the earth and its inhabitants, and this definition no doubt fully covers the subject. But it may be questioned if, in the ordinary treatment of the subject, such as it receives in our current text-books and lecture halls, we do it justice to the full extent suggested by our definition. Is it not too often merely the history of the inhabitants of the earth that we are treating, giving the history of the earth itself, *i. e.,* its physical development, only scant recognition? I believe I am not going too far when I say that we give proportionately too much attention to the biologic or paleontologic side, and too little to the physical or stratigraphic. I do not wish to be understood to say that paleontology receives too much attention in our institutions of learning. Far from it. Paleontology is not receiving a fraction of the attention it requires, and which it will receive in the future when our curricula are more normally balanced. But paleontology is not the whole of historical geology. Stratigraphy, or the physical characters and physical history of the rocks of the earth's crust—paleophysiography (if I may use a pet term, in spite of objections raised against it)—is fully one half of historical geology.

It is true, of course, that historical geology reposes on a foundation of paleontology—the divisions of the earth's history are based on the progress of life, and not, as has been too often assumed, on breaks in the sedimentary series, extensive and important as these may be. The standard of comparison must be a series of sediments which contain a continuous record of development, and since it is only in marine sediments that we get a continuous series, only marine formations, and such as do not represent merely local conditions, must be selected as our standard of reference.

Much as we prize, and justly prize, the classical standard of our North American Paleozoic series—the incomparable column furnished by the strata of the state of New York—and loath as we may be to attack any part of it, yet we must confess that it is not a perfect column throughout, and that the imperfection which it embodies can not be overlooked. Indeed, the sworn guardians of this monument have themselves recognized that it is an incomplete structure, and have introduced such foreign elements as the Cincinnatian group and the Richmond formation, besides accepting emendations proposed by others, such as Acadian and Georgian. They have, however, sought consolation for this forced recognition of the imperfections of the New York series, by proposing that the world at large accept the broader terms of the New York classification—Taconic, Champlainic, Ontaric—in place of the better known, though not always prior, terms Cambric, Ordovicic and Siluric.

But it is one thing to recognize the absence of an element in the standard series and to fill the gap by a foreign representative, and another to regard an old and well-known formational unit as imperfect, and as inexpressive of the time element which it represents, and to acquiesce in its replacement by another. Yet I believe this is what we shall come to in the case of such old standards as the Medina sandstone and the Salina group, not to speak of the Oneida conglomerate, formations which are still tolerated in the standard scale of North American Paleozoic formations, but which in a very imperfect manner represent the chronologic epochs for which they are commonly used. This is due to the fact that they were not deposited in the open sea, but rather under peculiar conditions, *i. e.,* estuarine, if not continental, in the case of the Oneida and Medina, and salt sea, if not desert, conditions in the Salina. Moreover, it is now pretty well ascertained that the typical Oneida

[1] An address delivered before Section E, American Association for the Advancement of Science, Syracuse meeting, July 21, 1905.

conglomerate of Oneida County is the time equivalent of the Upper Medina of the Niagara section, and that both probably should be united to the Clinton, while the lower 1,100 feet of the Medina of western New York may possibly represent the continental or estuarine phase of deposits, representing elsewhere the later Richmond period.

A satisfactory standard for the Lower Siluric is found in the island of Anticosti; and although this belongs to another geographic province of the Siluric seas, it represents far more completely the progress of biologic development than do the lower beds of the New York Siluric or, for that matter, any other Siluric beds deposited in the Siluric Mediterranean; unless the Mayville beds of Wisconsin should prove to represent the lowest Siluric.

To go, for a moment, outside of New York state, the same argument applies to the sediments of the mid-Carbonics, or Pennsylvanian, of eastern United States. Though now taken as a standard for comparison, to which all other Carbonic formations of North America are referred, they are manifestly unfit for this important position, not only because they represent continental conditions, and do not furnish us with a standard of marine sedimentation, but because it is obviously impossible to determine, at least with our present means, how complete the series is. There may be, and probably are, vast breaks in this series of non-marine sediments, breaks which may or may not be revealed in the floral succession. A far more satisfactory standard, and one more nearly comparable with the European standard, is that furnished by the mid-Carbonic sediments of Arkansas, Missouri and Kansas, or by those of Texas. When these sediments and their marine faunas have been fully studied we shall have a mid-Carbonic standard worthy of the name; and when that is accomplished—as we have good hopes that it will be before long, judging from the results already achieved by the labors of the earnest workers in those fields—then let us hope that the inappropriate term Pennsylvanian will be replaced by one more expressive of the marine sedimentation of that age.

But I am not here to speak of the imperfection of the geologic record, an imperfection which I think is more apparent than real, nor of the imperfection of our classification, which is more real than apparent. What I have said, however, will serve to define my position with reference to the importance of paleontology to the geologist. Let me return, then, to the consideration of the importance of the physical characters of our formation. I believe that the general neglect which this phase of the subject has suffered is in part due to the clumsy and unrefined nomenclature which we have inherited from the fathers of our science, and which, with the tacit, if not expressed, understanding that what was good enough for them is good enough for us, we have retained to the present time. So long as we express in our nomenclature that all stones composed of lime are limestones, and nothing more, so long, I believe, progress in the study of physical stratigraphy will be hampered. So long as we are content to use indiscriminately the structural terms slate and shale for rocks which have no other claim to these names than that clay generally enters into their composition—if that may be considered a claim—so long progress in this direction will be retarded. Naumann and Hauy long ago proposed textural terms for the three great types of clastic rocks, but these have been mostly overlooked by modern writers except the Germans, who are far ahead of us in the study of physical stratigraphy. It is true the terms of Naumann and Hauy, derived from the Greek, are not very euphoneous, nor do they lend themselves readily to composition, yet they are much better than indefinite descriptive phrases. Calcopsephyte and calcopsammyte do not fall pleasantly on the ear, yet they are far better than the indefinite terms, brecciated limestone—which might mean limestone brecciated by subsequent causes—or granular limestones—which might mean a number of different things. Certainly calcopelite is far better than the vague and roundabout phrase: 'compact, fine-grained limestone with conchoidal fracture,' which leaves you still in doubt whether the rock in question is a clastic, composed of lime flour, or a massive

organic rock in which all organic structure has been obliterated. Personally, I prefer terms derived from the Latin as being more adaptable in composition in this instance than the Greek terms of Naumann and Hauy; but whether we say calcopsephyte, calcopsammyte and calcopelyte or calcirudyte, calcarenyte and calcilutyte, is of minor significance, so long as we employ a term which will express exactly the physical characters of the rock. If the name at the same time expresses, in part, the history of the rock, by indicating it to be a clastic and not an organic rock, this can only be regarded as a further advantage. Certainly, if you understood that a lutyte was a clastic rock composed of fine rock flour, you would, I think, be in favor of describing many of the beds of the Manlius and water-lime of this region as argillaceous calcilutytes or pure calcilutytes, as the case may be, rather than to speak of them as: 'compact, finely-bedded argillaceous limestones with conchoidal fracture and of an impalpable grain.' I should, at any rate; for, if nothing more than brevity is gained, the short term is a distinct advantage.

But the application of a more precise nomenclature to the clastic rocks is only a first step in the right direction. The lithic character of the rocks must be studied with reference to their origin, *i. e.*, the lithogenesis of the formations must be considered, and the bearing which this has on the distribution of land and sea in past geologic epochs. The careful study of local sections, the measurements of thicknesses and the determination of the distribution of fossils, are of course, an important preliminary. But while this is done, a careful diagnosis of the lithic character of the rock and a determination of its source should be made, and special care should be given a precise description of its relationship to adjacent formations. The latter feature is too often neglected, when it is of the greatest importance, as an example will show. Most of the descriptions of the Chattanooga black shale which I have been able to find speak of it as a black bituminous shale, with some few additional remarks on its petrographic character. They mention the fossils which are found in it and refer the formation to the Devonic, with sometimes a more precise reference to the Marcellus or the Genesee of New York. But its relation to the succeeding formation is almost never discussed. Here and there in the literature we find a hint, and only a hint, that it grades up into the overlying rock. Rarely is there a more precise description of this gradation, like William's description of its relation to the overlying Grainger shale. And yet this is of very great importance, for if the Chattanooga shale of eastern Tennessee is Devonic, then there is not only a pronounced hiatus at its base, but another at its top, for the immediately overlying Fort Payne beds represent in some localities the St. Louis, in other the Keokuk. In still other localities we find beds of Chester age following immediately upon the black shale, which often is only a few feet thick, while in other localities again these black shales are succeeded by beds of Burlington or Kinderhook age. If, as I strongly suspect, and as seems to be occasionally hinted at in the literature, there is no hiatus at the top of the black shale, but a transition to the overlying formation, then the black shale surely represents the basal formation formed by a sea transgressing southward and eastward over a peneplained land surface, and its age varies in different localities. At the type locality, Chattanooga, Tennessee, the age of the black shale is in that case Burlington or perhaps early Koekuk, while at others its age is St. Louis, or even later. Only in the northern region, where it is succeeded by Kinderhook beds, as at New Albany, Indiana, and at Big Stone Gap, Virginia, is the black shale of Devonic age.

And this brings me to the consideration of another factor which is all too often overlooked in stratigraphic work. This is the phenomenon of progressive overlap, and the complementary one, which, for lack of a better term, we may call regressive overlap. We all agree that in normal sedimentation coarse clastic rocks are formed near shore, finer farther out and the finest impalpable flour is only deposited at a great distance from the normal shore, while clastic limestone may be

formed anywhere under favorable conditions. But we do not generally apply this principle in the elucidation of our rock sections. When, for example, a prolonged subsidence of the land occurs, resulting in the overflow of the land by the sea, the waves of the advancing sea will work over the residual soil of the land which it overflows and will spread a basal layer of conglomerate or sand or, in rare cases, of mud over the old land thus submerged, the nature of the basal bed depending on the character of the rock débris which covered the old land, the slope of this old land and the consequent depth of the encroaching sea, and the rapidity of the submergence. This latter may be so great that areas of land are suddenly submerged, while the shore is transferred far up on to the old land, so that offshore deposits, like organic limestones, may form directly on the old land surface.

The basal layer thus formed will not be of the same age throughout, but will rise in the scale with the advance of the sea. Seaward, finer deposits will be laid down upon the basal formations, these finer deposits corresponding in age to the basal sandstone at that time forming near the shore. To illustrate: the basal sands of the Cambric Ocean were spread by an advancing sea over the crystalline rock floor. East of Lake Champlain this basal sandstone belongs to the Lower Cambric, but westward it rises in the scale until at the foot of the Adirondacks it is the Potsdam sandstone of Upper Cambric age, while the corresponding deposits further east are clay and lime-rocks. Again, while on the east of the Adirondacks, at the point of present outcrops, the basal sandstone is Potsdam, followed by calciferous sand-rock and by purer calcarenytes of Beekmantown age, the outcrop on the west of the Adirondacks shows similar basal quartz sandstones, followed by calciferous sand-rock and later by pure calcilutytes, but all, from the base up, of Lowville or Upper Chazy age. The Beekmantown and Potsdam are here overlapped by the later deposits, which, however, repeat the lithic sequence seen in the section of earlier age on the east of the Adirondacks. Wells sunk in the neighborhood of Syracuse to the crystalline rock, find a quartz sand-rock (silicarenyte) resting immediately on the crystalline, followed by a calciferous sand rock (calcareous silicarenyte), which grades up into siliceous calcarenyte, and finally into pure calcarenytes or clastic limestones. Lithically considered, this section might be regarded as representing the whole series from Potsdam up, whereas in reality the basal bed is Beekmantown, if not Upper Chazy.

Regressive movements of the sea, by which large tracts of previously submerged land become exposed, also leave a record in the sedimentary series which, by careful consideration, can be detected. Thus a comparison of sections shows that we have in the Mohawk Valley some three or four hundred feet of Beekmantown, which in places, as at Little Falls, rests directly upon the gneiss with a basal rudyte. These Beekmantown beds probably represent the lower, though probably not the lowest, members of that formation, judging from the presence of *Opheleta complanata*. Not more than a hundred and fifty miles south, in central Pennsylvania, the Beekmantown is represented by over two thousand feet of similar strata, followed by some two to three thousand feet of the Stone's River group, which in the Mohawk is represented by less than a hundred feet of its upper portion, and there known as Lowville. Similarly, in the upper Mississippi region the Lower Magnesian limestones, which indicate a continuous deposition from the Upper Cambric, are less than three hundred feet in thickness and represent the lowest Beekmantown. The Stone's River, or Chazy, is represented by less than a hundred feet of strata, which grade upward into the Black River, as do the corresponding strata—Lowville—in the Mohawk and Black River Valleys. These Stone's River beds of Minnesota, from their relation to the overlying beds, and from their fossils, are seen to be the uppermost portion of that series. Between the lowest Beekmantown and the highest Chazy (or Stone's River) lie about 200 feet of pure quartz sandstone—a typical silicarenyte—known as the St. Peter sandstone. This sandstone has been traced very widely over the Mississippi Valley region; but as

we follow it southward the thickness of Beekmantown below and Chazy above increases more or less regularly, until in Indian Territory, where the St. Peter thins away, we have nearly two thousand feet of the Beekmantown and more than that of the Chazy or Stone's River. These facts point to a very remarkable episode in North American Ordovicic history, namely, the slow retreat of the sea from the upper Mississippi Valley, which as it retreated gradually washed the sands of the northern shore seaward, spreading them over the previously deposited offshore beds. As the sea retreated, deposition came, of course, to an end. Thus when the retreat had reached southern Minnesota, only the lower 250 feet of Beekmantown had been deposited, and there deposition stopped. When the retreating seashore had reached central United States, only the lower thousand feet of Beekmantown had been deposited, and only in southern United States, which was not laid bare, was there a complete deposition of the calcarenytes and organic limestones of the Beekmantown. The area uncovered—the whole of central United States—was spread over by the sand left by the retreating sea, and this was no doubt blown about by the wind, the grains rounded and the remarkable structure and purity of the St. Peter—probably the best example of an ancient desert rock extant—was thus produced. When the sea again advanced over this desert area, the upper portion of these sands was worked over and became true water-laid deposits, and at the same time graded up into the overlying calcareous beds. By the time the sea had advanced half way to the old northern shore, a thousand feet, more or less, of the lower Chazy had been deposited in the southern states. At the point then reached Chazy deposition began with the middle members of the formation. By the time the sea had reached its northern shore, from which it originally retreated, and which was somewhere north of Lake Superior—the whole of the Chazy—nearly 2,000 feet had been deposited in the southern states, the upper thousand in the central states, but only the uppermost 50 or 75 feet in southern Minnesota. The St. Peter, thus representing a retreatal sandstone, worked over by the winds, also represents a basal bed of an advancing sea; and while the last remnants of it in southern United States mark practically no break in the sedimentary series, this same rock in southern Minnesota occupies the interval between all but the lowest Beekmantown and all but the highest Chazy.[2]

Now, in New York state we have no St. Peter, but we have the other conditions precisely like those of the upper Mississippi Valley. The lowest Beekmantown is followed by the highest Chazy, the interval unrepresented between the two being marked in central Pennsylvania by over 4,000 feet of sediment. This break, or stratigraphic unconformity, long suspected, has recently been actually located in the Mohawk Valley by Professor Cushing. It should be remarked that during all the time that central and western New York was dry land, *i. e.,* during the time occupied by the formation of 4,000 feet of limestone strata elsewhere, continuous or nearly continuous deposition went on in what is now the Champlain Valley.

We must now consider a somewhat more complicated series. In western New York the Lorraine beds—considered the highest of the Ordovicic—are followed by red lutytes and arenytes (mud-rocks and sand-rocks), over a thousand feet thick, and unfossiliferous. At the base is a quartz sandstone, about 75 feet thick, and over it are about a hundred feet of quartz sandstones, mostly red, and some shales which contain marine fossils closely allying them to the overlying Clinton. I speak, of course, of the Medina formation. A little south of Utica, the Lorraine shales, represented only by their lower hundred feet, are succeeded by the Oneida conglomerate, a pure quartz-pebble conglomerate with well-rounded pebbles. This conglomerate, less than 50 feet thick, is followed by the shales, sand, mud and lime rocks of the Clinton. The base of the conglomerate is fossiliferous, the fossil—*Arthophycus harlani*—being the same which is restricted to the top beds of the Medina in western New York. In the cement region of

[2] Dr. C. P. Berkey will shortly publish a detailed discussion of the St. Peter problem.

Ulster County a similar white quartz-pebble conglomerate, the Schawangunk grit, lies unconformably upon the upturned and eroded Hudson River beds, and is followed by less than a hundred feet of red lutytes and arenytes, and then by the cement beds, which, by their enclosed fossiliferous bands, prove their identity with similar beds overlying the Salina in western New York. Close inspection of the series shows continuity of deposition, which proves the age of the red beds and the Schawangunk conglomerate to correspond to that of the New York Salina. Still further east, in Rensselaer County, a similar conglomerate, the Rensselaer grit, rests unconformably on Cambric and Hudson beds. How shall we interpret these sections? At the end of Ordovicic time the folding of the Ordovicic strata of eastern United States took place—what is familiarly known as the Green Mountain revolution. So far no strata later in age than Lorraine have been found in these folded beds; hence it is safe to assume that strata of Richmond age were never deposited in eastern United States; in other words, that the folding began at the end of Lorraine time. This folding was, no doubt, accompanied by an elevation of the land, and a westward retreat of the interior sea. Elevation of an old land is commonly followed by vigorous stream activities, which results in erosion. In the present case the products of this erosion were spread by the streams over the land exposed by the retreating sea. This is the ultimate mode of origin of the conglomerates in question and of the red sandstones. The red colors of the sands and muds indicate that they are the product of the subaerial decay of rocks; and the only rocks at all competent to furnish the material of these strata are the crystallines of the Appalachian old land, as long ago pointed out by Davis and others. That the conglomerates and their representative in western New York, the basal sandstone of the Medina, are, in part at least, river deposits, later on worked over by the sea, seems unquestionable, for though the retreating sea would wash out seawards the materials of the shore, such thick masses of pebbles can hardly be carried so far from their source without the aid of rivers. A comparison of the Siluric sections of the Appalachians suggests that the conglomerates and sandstones are part of a huge subaerial fan, whose apex was in southeastern Pennsylvania, and which thinned away radially in all directions. That a part of this fan was formed during Richmond time seems probable, and is further indicated by the occurrence of marine Ordovicic fossils in what was probably the margin of the fan in Virginia. However, a great deal of careful comparative study is needed to unravel the complete history of these deposits.[3]

In central United States the Richmond is succeeded by marine deposits commonly correlated with the Clinton of New York. Though land conditions, accompanied by erosion, are indicated in many localities, in some cases the lowest Siluric sediments seem to rest directly upon the highest Ordovicic. It is impossible to determine from the literature whether in any of these cases continuous deposition occurred or not. Further field examinations will have to settle that. Marine conditions came into existence again in western New York in Upper Medina time, and gradually transgressed eastward. The Siluric sea reached as far as Utica in Upper Medina time, but did not reach Ulster County until the conditions of the deposition of the Salina beds were instituted in central and western New York—if at that time marine conditions existed at all in New York. The continued red sedimentation, which is so pronounced throughout the Salina sediments and which appears to indicate a continuous supply of highly oxidized material from the old land on the east, and, further, the presence of true Salina strata only along the inner margin of the Appalachians, their great thickness in the east and their thinning away to the west, all suggest that land conditions, rather than marine, existed in this period. That marine deposits were forming in some region is indicated by such sections as that near Cumber-

[3] Investigations of this problem are now in progress under the auspices of the New York State Geological Survey.

land, Maryland, but the typical salt and gypsum-bearing Salina beds, such as furnish the salt of Syracuse, have characters which seem explicable only on the supposition that all this region was a desert country, with much evaporation and comparatively little rainfall, and that the basins in which salt accumulated were shallow pools, rarely, if ever, flooded by the sea, the salt being bleached out of the surrounding marine sediments by the occasional rains and left by the evaporation of the water. But here, as in the case of the Medina, much detailed study of the lithic character of the formation is necessary before we can do more than make provisional hypotheses. We know, however, that marine conditions were reestablished over all New York towards the end of Siluric time. As Hartnagel and Schuchert have shown, the sea invaded eastern north America by a transgression of the Atlantic waters. At the same time a trangression from the southwest appears to have occurred, which brought with it a different type of fauna, the two together constituting the Cobleskill. The Manlius limestones represent typical marine conditions; but you will have noticed that many of the lime mud-beds or calcilutytes show mud cracks, which indicate water so shallow that occasional emergence was possible. The Manlius beds grade upwards into the fossiliferous calcarenytes, which, as the Colymans limestones, form the basal Devonic beds of the New York section. This and the higher beds of the Helderbergian series are now no longer found, except as remnants, in this region, erosion having removed most of them. You will bear in mind that this erosion was a pre-Onondaga erosion, for the Onondaga rests everywhere in this region upon the eroded surfaces of the Colymans or the Manlius. This erosion belongs to Oriskany time, for continuous deposition into the Lower Oriskany is shown by the section at Becraft Mountain. What the amount of erosion was and what the length of time during which it was accomplished, we have at present no means of judging. There is every reason to believe that the highest Helderberg strata extended at least as far as Syracuse, and there is reason to suppose that they extended farther and overlapped the lower ones. But the Oriskany erosion has removed all this. The hiatus, though pronounced, is scarcely noted by the casual observer, because the formations are perfectly conformable, so far as position of strata is concerned. We need a term to express the relation where two formations thus conform in their bedding but comprise between them a time break of greater or less magnitude. To speak of such strata as unconformable, without qualifying the term, is misleading, since it suggests that the older strata have suffered folding and erosion before the deposition of the later. Until a better term is proposed, we might speak of such formations as *dis*conformable, leaving the term unconformable for cases in which discordant relationship of bedding occurs.

The disconformable relation of the Onondaga upon the Manlius or Colymans is sometimes qualified by the occurrence of lenses of Oriskany between them. The relationship of the Oriskany and other overlying formations is best brought out by the consideration of a few sections. In the Hudson Valley the lowest Oriskany—that of Becraft Mountain—is a direct successor, without break of deposition, of the uppermost Helderbergian, the Port Ewen. It is succeeded by about three hundred feet of dark argillaceous silicilutytes, the lower part of which are the Esopus and the upper the Schoharie. Above this come the Onondaga limestones, the transition being a complete, though rather rapid, one. In the Schoharie Valley later Oriskany rests on eroded Helderbergs, and is followed by about 100 feet of the dark lutytes, mostly of Esopus or Caudagalli age. West of this region the Oriskany occurs at irregular intervals, while the Esopus has thinned away. Finally, at Cayuga Ontário, half-way between Buffalo and Detroit, the uppermost Oriskany alone occurs, resting on eroded lower Manlius and intimately related with the overlying Onondaga. Here, then, is no room for Esopus or Schoharie, for Onondaga is the direct and immediate successor of latest Oriskany. This indicates a westward transgression of Oriskany sediments, the later beds overlapping

the earlier ones. The dark mud rocks, therefore, are the shore equivalents in the east of the highest Oriskany limestones of the west, and not an independent unit in the time scale.[4]

But I must not carry my discussions further, since my time, unfortunately, is limited. I hope you agree with me—those of you, I mean, who are not stratigraphers, for stratigraphers require no conversion at my hands—that the study of the physical characters of the strata, even of the thickness of sections, gives, when rightly attacked, a view of the history of the earth, full of dramatic intensity, and that only by a careful study of such physical characters can we arrive at a true interpretation of the history of the earth.

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EXTIRPATION AND REPLANTATION OF THE THYROID GLAND WITH REVERSAL OF THE CIRCULATION.

WE have successfully removed and then replanted a thyroid gland with reversal of the circulation on a dog.

A transplantation of the thyroid with anastomosis of its vessels to a suitable artery and vein was previously made in 1902,[1] but no permanent successful result was obtained, owing to the obliteration of the vessels by clots and the subsequent development of gangrene. A careful investigation of the literature has revealed no other mention of similar experiments having been performed hitherto. The present observation is also the first successful replantation of a gland with reversal of the circulation.

Summary of the Technique and of the Observation on the Results of the Operation.—The right thyroid gland of about a 20 K. dog having been dissected, all its vessels were ligated, except the superior thyroid artery and vein, which were cut near the carotid artery and the internal jugular vein. The gland was then extirpated and put in a glass of isotonic sodium chloride solution.

After a few minutes, the thyroid gland was placed in the wound in the neck, and the peripheral end of the thyroid artery was united to the central end of the thyroid vein, and the peripheral end of the thyroid vein to the central end of the thyroid artery.

The circulation was reestablished about half an hour after the extirpation. The circulation through the gland was in a direction reverse to the normal. The red blood entered through the thyroid vein, and the dark blood flowed from the gland to the jugular vein through the thyroid artery. The hue of the gland was normal, and the circulation very active.

Eleven days after the operation the wound was opened and the anterior portion of the gland directly observed. The gland was somewhat enlarged, but its hue and consistency were normal.

Twenty-five days after the operation it was again directly observed. It still appeared enlarged, and in hue and consistency the same as before.

Thirty-two days after the operation, the wound being almost closed, it was not possible to examine the gland directly. But by pressing it between the fingers through the skin, its systolic expansion was easily detected.

At the present time forty seven days after the operation the animal is alive and in good condition. The replanted gland appears to be practically normal, being only slightly enlarged.

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[4] A more detailed discussion of this problem appears in my forthcoming bulletin on the Schoharie Valley (Bull. N. Y. State Museum).

[1] A. Carrel, 'La Technique operatoire des anastomoses vasculaires et la transplantation des visceres,' *Lyon Medical*, 1902. 'Les anastomoses vasculaires, leur technique operatoire et leurs indications,' 2e Congrés des Médecins de langue francaise de l'Amérique du Nord, Montreal, 1904.

EXHIBITION OF EARLY WORKS ON NATURAL HISTORY.

FEW people are aware that the Natural History Museum in Cromwell-road contains one of the finest and most complete libraries on natural history ever brought together. The collection had its origin in the several libraries attached to the departments of zoology, geology, mineralogy and botany while these were